



MYCOLOGY WORLD

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MYCOLOGY

MYCO = FUNGUS

LOGY = SCIENCE or STUDY

Mycology is the study of fungi ..or it is a branch of biological science dealing with the study of fungi

WHAT ARE THE FUNGI?

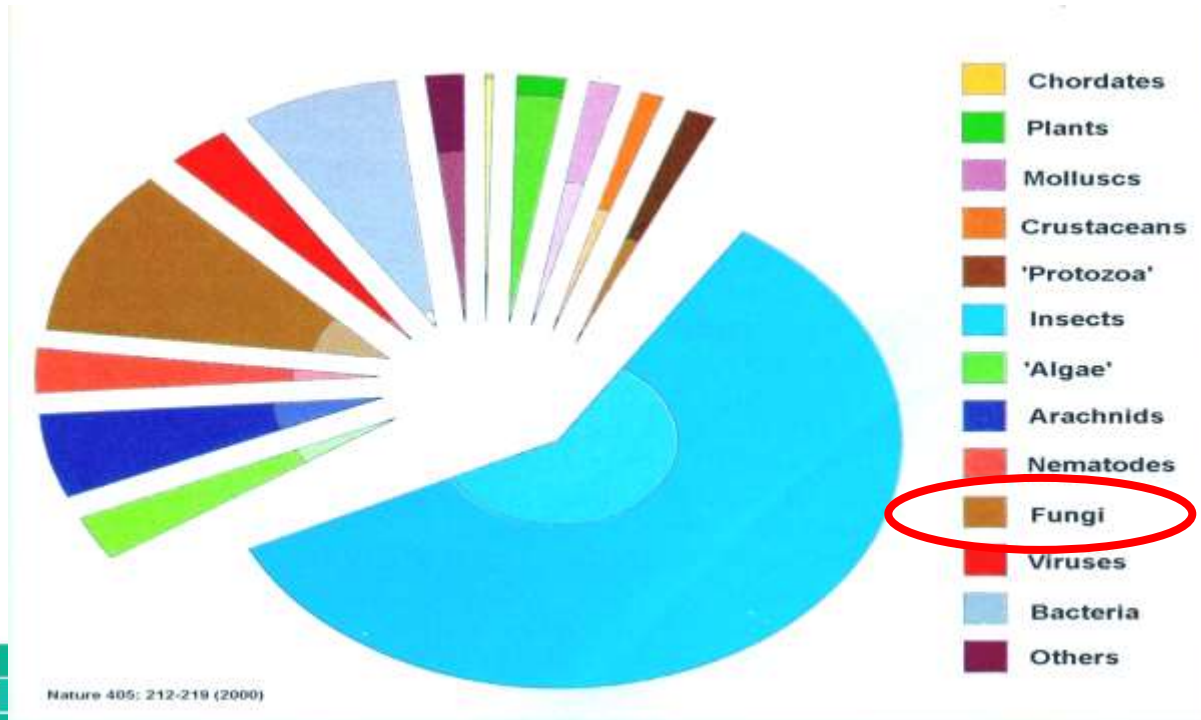
Fungi are not plants.

Fungi form a separate group of higher organisms, distinct from both plants and animals





THE CREATURES





GENERAL CHARACTER OF FUNGI

Fungi:

Are **Eukaryotic** microorganisms have a **nucleus**, their organelles may or may not have a membrane, and they reproduce **asexually** or **sexually**.

FUNGI GENERAL CHARACTERISTIC

Fungi are **heterotrophic** ("other feeding" must feed on preformed **organic material**), not **autotrophic** ("self feeding", make their own food by **photosynthesis**) Relatively simple nutritional requirements

A decorative horizontal bar at the bottom of the slide, composed of many small squares in various shades of blue, green, yellow, and orange, creating a pixelated or mosaic effect.

FUNGI GENERAL CHARACTERISTIC

Fungi **obtain** their **nourishment** by **secreting** enzymes for external **digestion** and by **absorbing** the **nutrients** that are released from the **medium**

FUNGI GENERAL CHARACTERISTIC

Fungi range in form and size from **unicellular yeasts** to large **multicellular mushrooms** and **puffballs**.

Non-motile eukaryotes **lacking chlorophyll**

Contain **nucleus**, **mitochondria**, **80S ribosomes**

FUNGI GENERAL CHARACTERISTIC

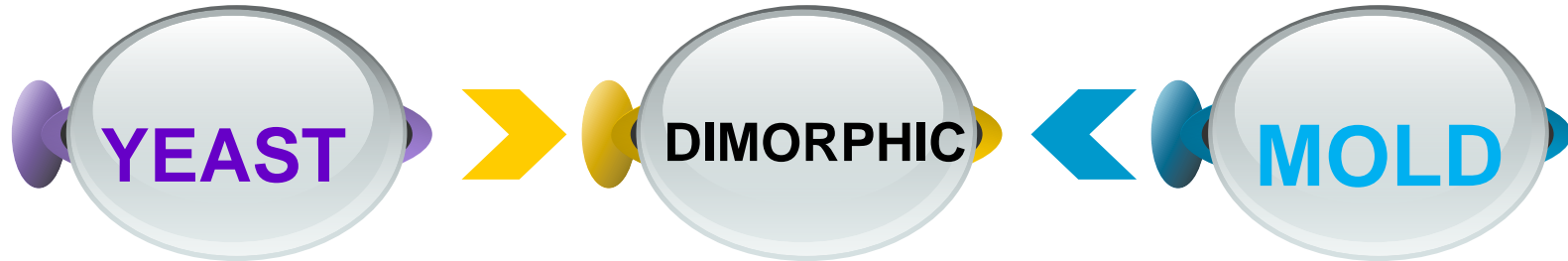
Cell wall is similar to plant cell wall but it composed of chitin and various glucans, mannans, and complex polysaccharides (plant cell wall cellulose)

FUNGI GENERAL CHARACTERISTIC

Most fungi store their food as **glycogen** (like animals); plants store food as **starch**

Fungal **cell membranes** have a **unique sterol, ergosterol**, which replaces **cholesterol** found in mammalian cell membranes

FUNGI GENERAL CHARACTERISTIC



UNICELLULAR

ROUND-OVAL

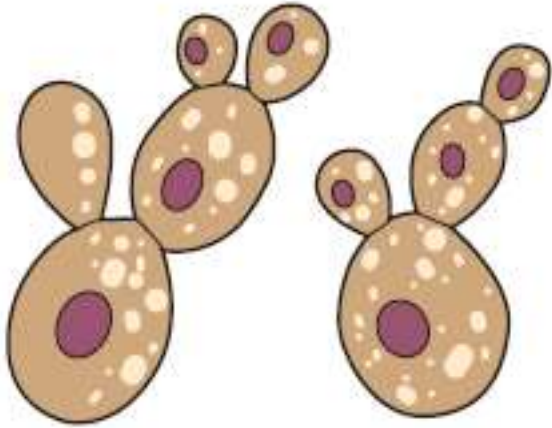
BUDDING

MULTICELLULAR

FILAMENTOUS-TUBE

HYPHAE-MYCELIA

FUNGI MORPHOLOGICAL FORMS



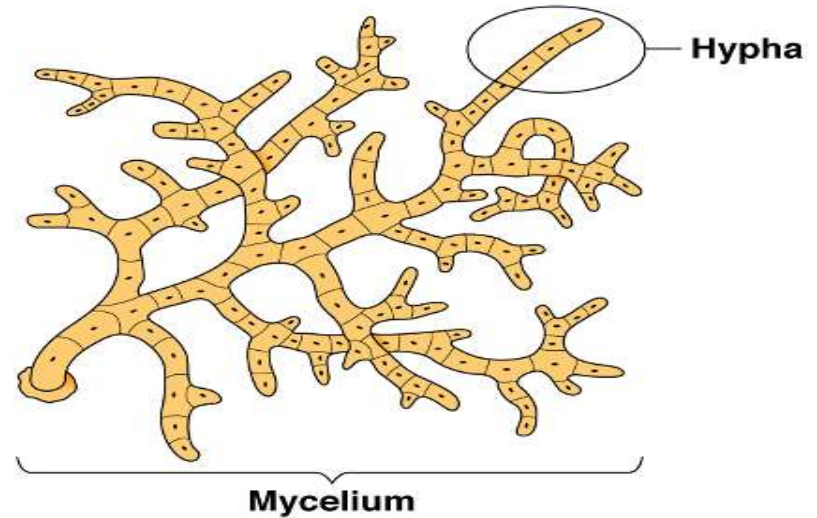
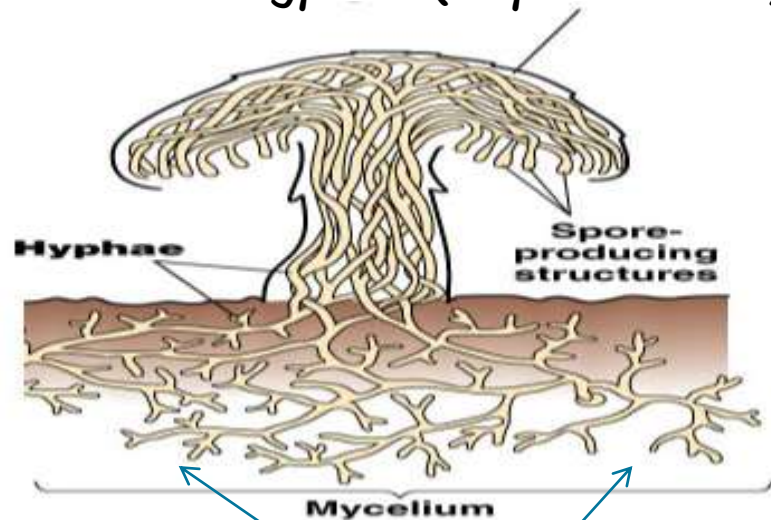
Budding yeast



Pseudohyphae

FUNGI MORPHOLOGICAL FORMS

Aerial hyphae (Reproductive)

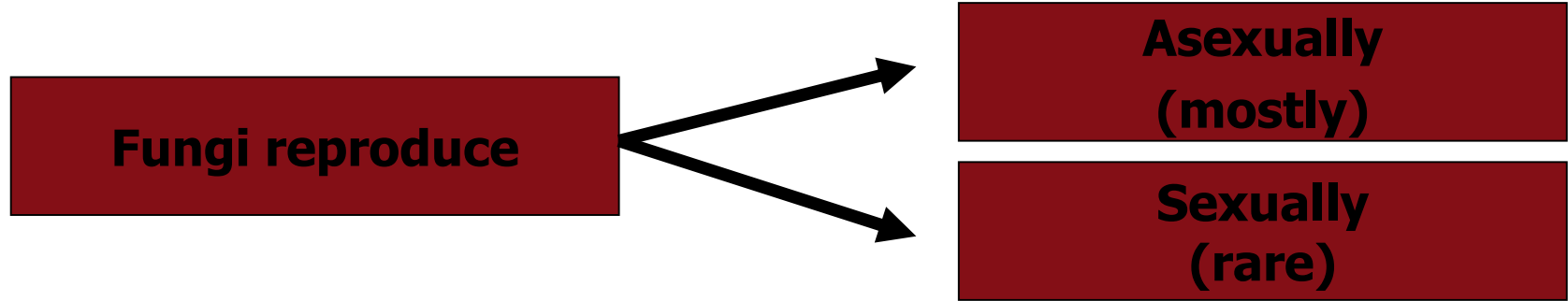


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Rhizoidal hyphae (Vegetative)

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Fungi reproductive classification



 **Reproduce by means of spores (usually wind-disseminated)**

Fungi reproductive classification

Anamorph= asexual stage

spore formed via asexual reproduction (mitosis),
commonly called a conidium or sporangiospore

Teleomorph= sexual stage

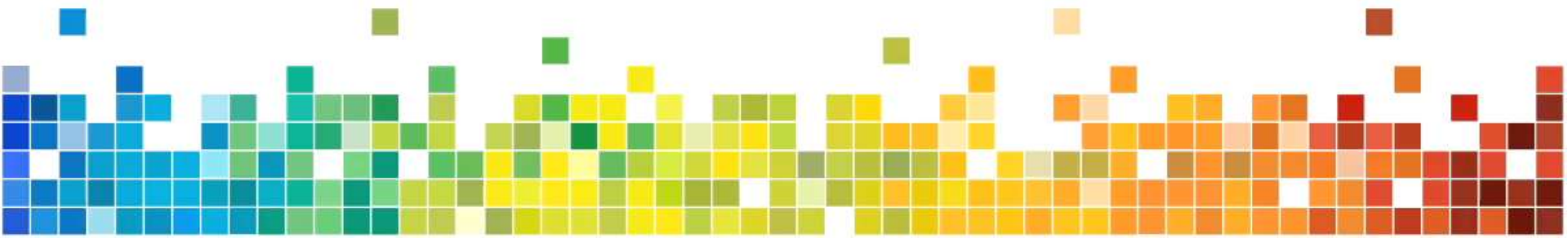
spore formed via sexual reproduction (meiosis),
type of spore varies by phylum

Nutritional Status of Fungi

 **Saprophytes**

 **Parasites**

 **Mutualists (symbionts)**



Saprophytes

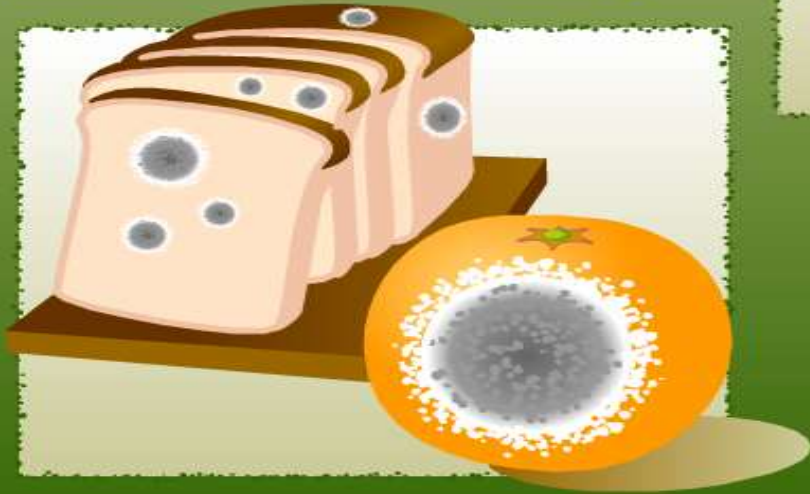
■ Use **non-living organic** material.

■ Along with bacteria, fungi are important in recycling carbon, nitrogen, and essential mineral nutrients.

Many fungi are saprobes.

Saprobe:


An organism that obtains carbon and energy from dead organic matter







Decomposers

 As saprotrophs, particularly as decomposers, fungi are essential components of the carbon cycle and are among the few organisms that can break down lignin

Parasites

■ **Use organic material from living organisms, harming them in some way**

■ **Range of hosts: plants – animals – humans**

Some fungi are parasites.

Parasite:

An organism that benefits from its close association with an organism of another species (the host); the benefit is at the expense of the host

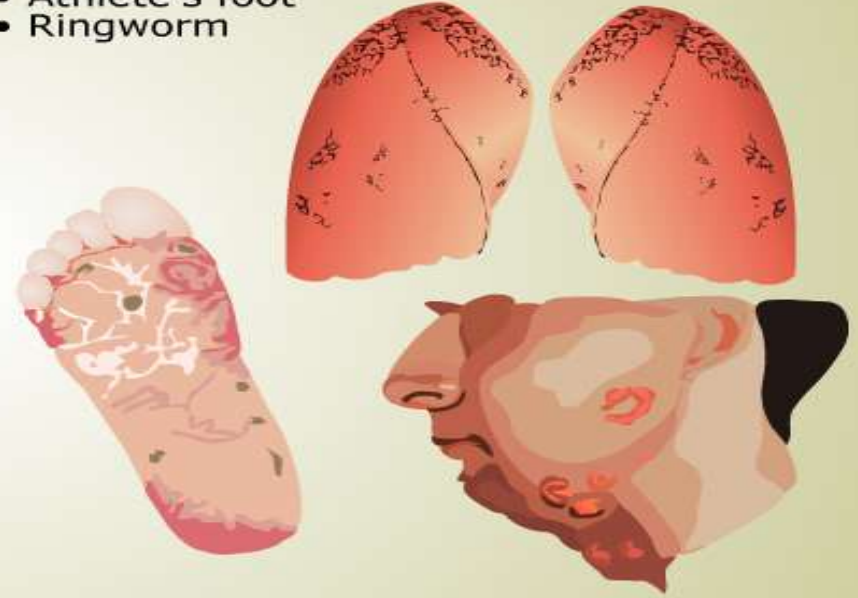
Parasitic fungi cause plant diseases:

- Dutch elm disease
- Chestnut blight
- Various rusts, smuts, scabs, rots, and wilts



Parasitic fungi cause human diseases:

- Histoplasmosis
- *Pneumocystis* pneumonia
- Athlete's foot
- Ringworm



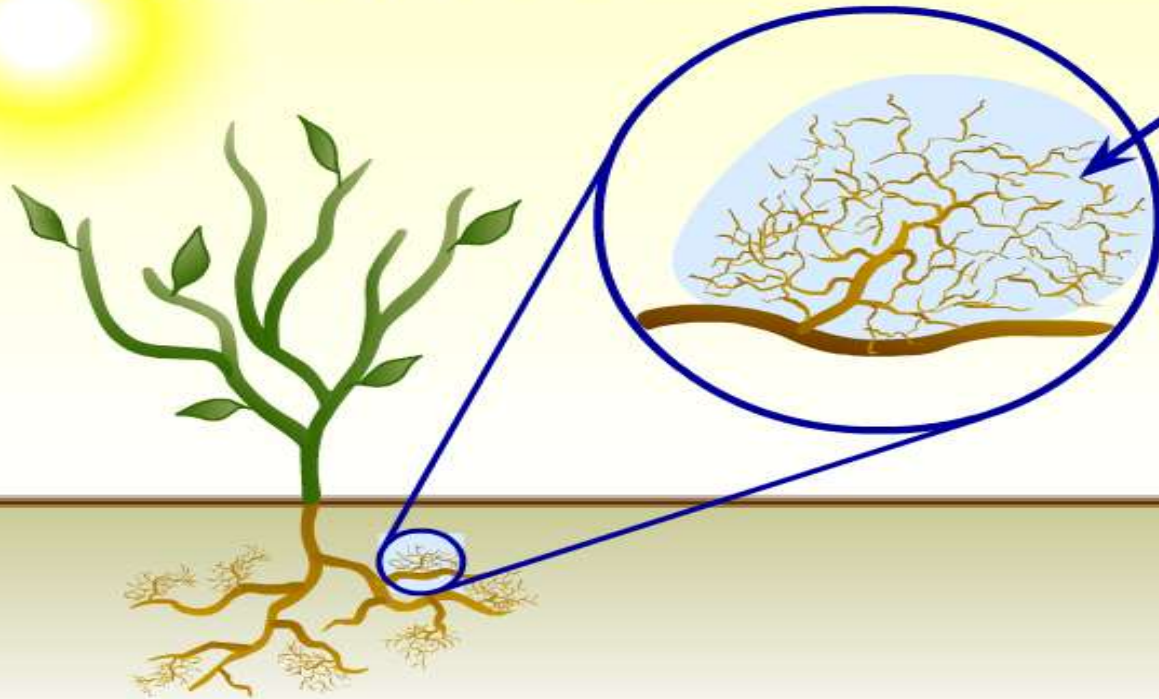
Mutualists (Symbionts)

■ Fungi that have a beneficial relationship with other living organisms.

■ Mycorrhizae: associations of fungi with plants' roots.

■ Lichens: associations of fungi with algae or cyanobacteria

Many fungi are symbionts.



Mycorrhiza:

The symbiotic association of the root of a plant with the mycelium of a fungus

Symbiont:

An organism that lives in a symbiotic relationship with another organism

Symbiosis:

The living together of two dissimilar organisms in close association





Importance of Fungi



Fungal Species

>250,000 species, most are saprophytic

~500 species, pathogens of humans/animals (0.5%)

~8,000 species, plant pathogens (8%)

Over 65% of plant diseases are caused by fungi



Fungi .. Harmful to Human Interests

- Can cause human disease, either directly or through their toxins.
- Can cause diseases of plants and animals that humans are interested in (*e.g. Crops .. etc.*).
- Cause rot and contamination of foods.
- Can destroy almost every kind of manufactured good – with the exception of plastics and some pesticides.

Fungi .. *Useful to Human Interests*

- **Yeasts: baking and brewing**

- **Antibiotics (penicillin and cephalosporin)**

- **Other drugs (cyclosporin)**

- **Many organic acids are commercially produced with fungi; Citric acid in Coke is produced by an *Aspergillus*.**

- **Steroids and hormones (the pill).**

- **"Stinky" cheeses (Roquefort and Camembert).**



Fungi Morphological Classification

Yeasts

**Filamentous
fungi (molds)**

Dimorphic



Fungi Morphological Classification

Yeasts

Filamentous
fungi (molds)

Dimorphic

The basic element of the unicellular fungi.
It is **round** to **oval** and 3 –10 μm diameter.

Single cells, reproduce by budding

separate : *Cryptococcus neoformans*

attached : *Candida albicans*

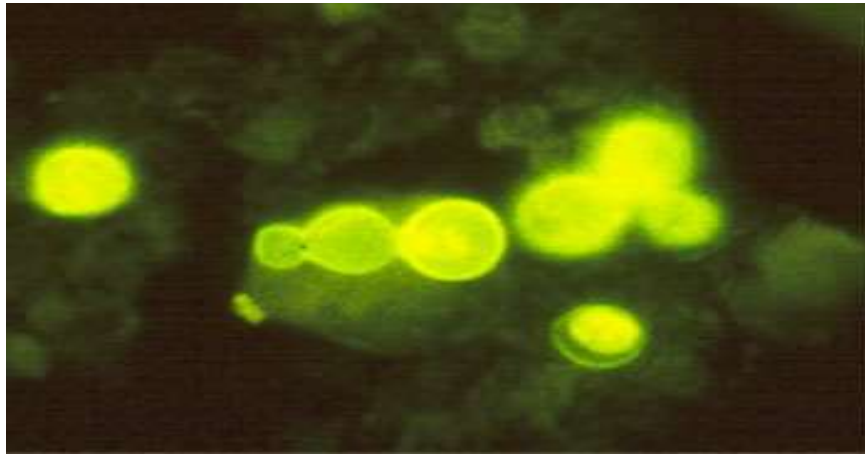
Dr. Mahmoud ElHariri



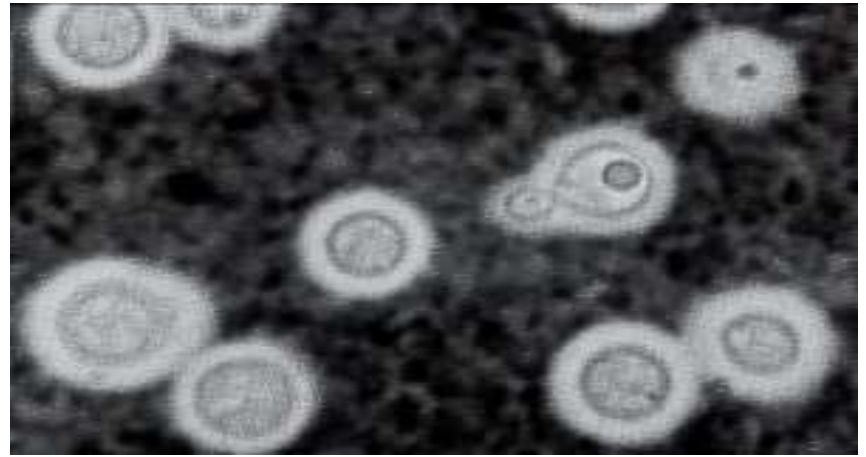
C. albicans
white colonies
on SDA.



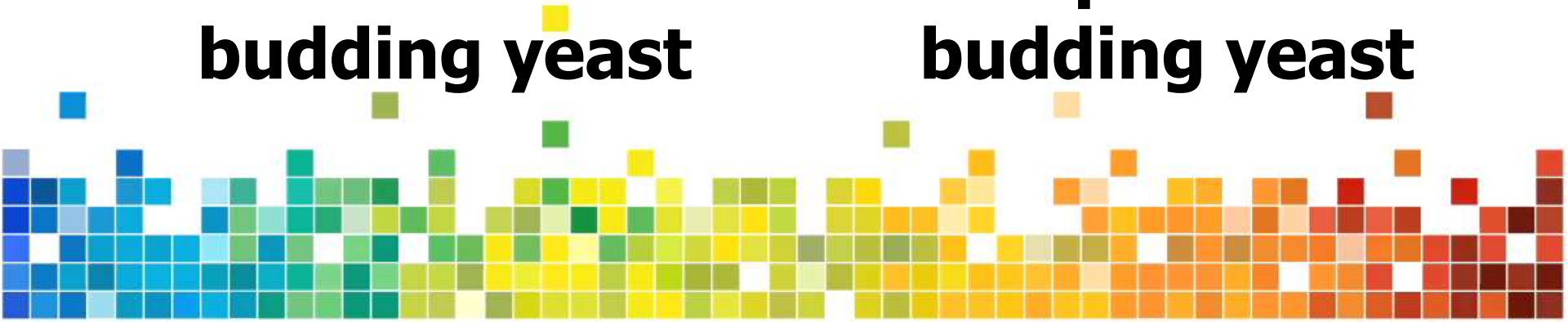
Geotrichum
white wrinkled
colonies on SDA.



**Attached
budding yeast**



**Separated
budding yeast**



Fungi Morphological Classification

▶ Yeasts

▶ Filamentous fungi (molds)

▶ Dimorphic

Grow as threads (hyphae) Interlace to form mycelium

Septated non colored hyphae :

Aspergillus spp, Dermatophytes. Penicillium spp, Fusarium spp

Colored hyphae (Dematiaceous fungi):

Alternaria, Phialophora

Fungi Morphological Classification

Morphology terms:

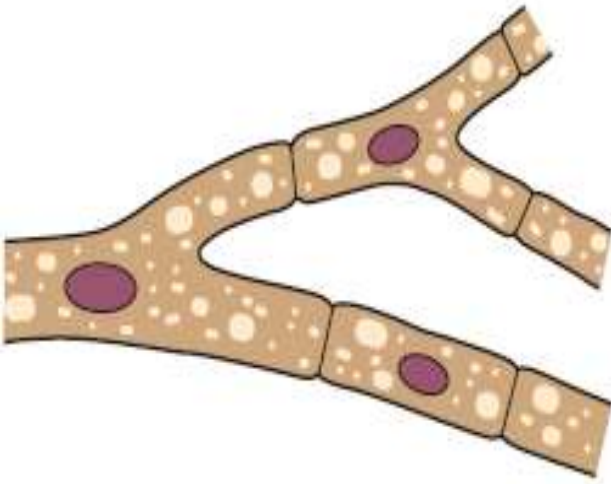
Hypha:

is the basic element of filamentous fungi with a branched, tubular structure, 2–10 μm in width.

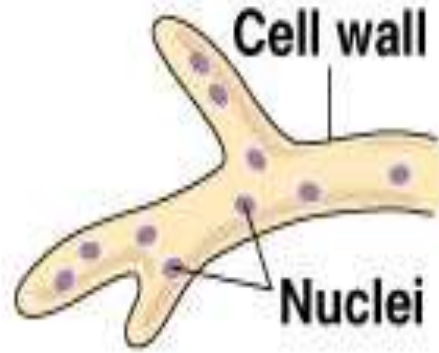
Mycelium:

is the web or matlike structure of hyphae. **Substrate mycelia** (specialized for nutrition) penetrate into the nutrient substrate, whereas

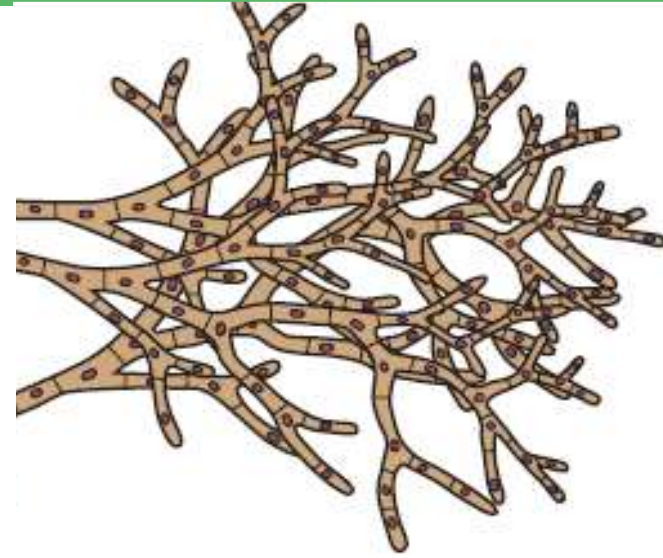
aerial mycelia (for asexual propagation) develop above the nutrient medium.



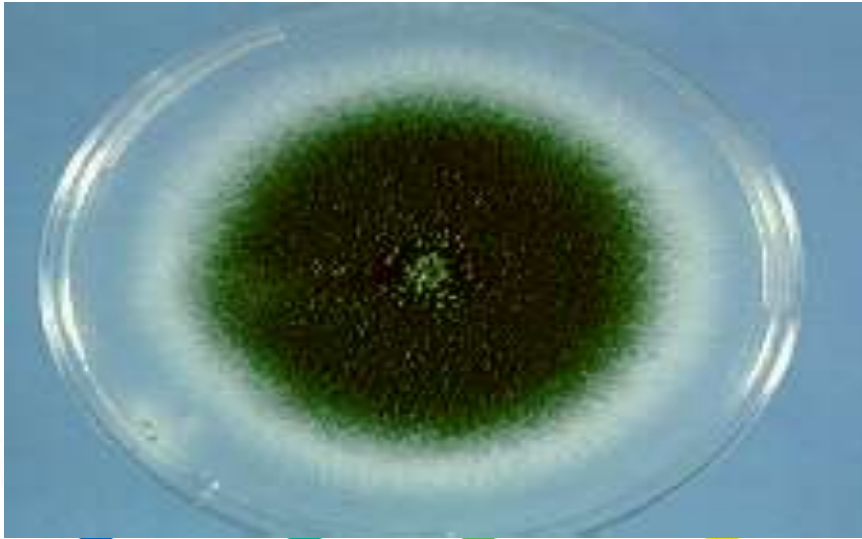
**Septated
Hyphae**



**Aseptated
Hyphae
(coenocytic)**



**Branched
hyphae web
(Mycelium)**



**Aspergillus
fumigatus**



**Air sacs of a hen
during epidemic
aspergillosis**

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The Geraldine Kaminski Medical Mycology Library
Produced by: David Ellis and Roland Hermanis
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Penicillium species

Fungi Morphological Classification

Yeasts

Filamentous
fungi (molds)

Dimorphic

Single cells, reproduce by budding exist in two forms

(*Histoplasma capsulatum* , *Blastomyces dermatitidis*)

Yeasts (at 37 °C) Or Molds (at 27 °C)

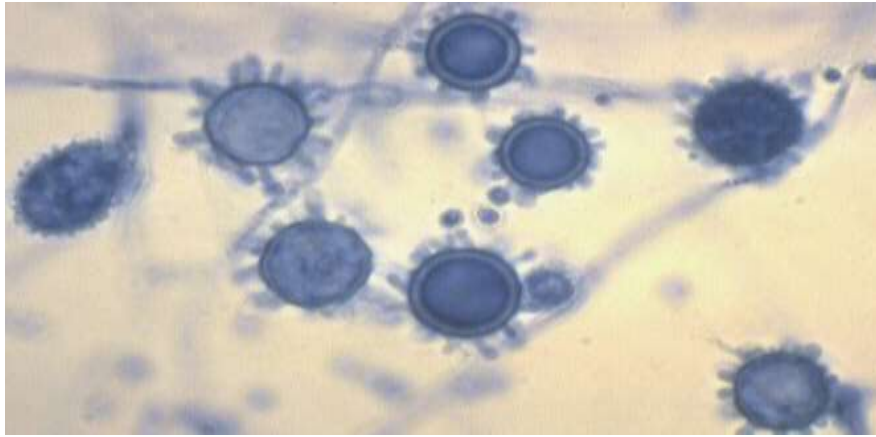
Fungi Morphological Classification

Morphology terms:

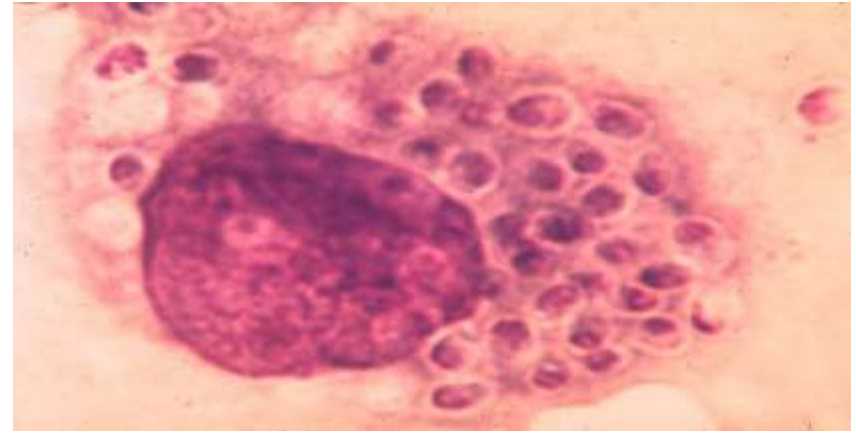
Dimorphism:

some fungal species can develop either the **yeast** or the **mycelium** form depending on the environmental conditions, a property called dimorphism.

Dimorphic pathogenic fungi take the form of **yeast** cells in the **parasitic stage** and appear as mycelia in the **saprophytic stage**.



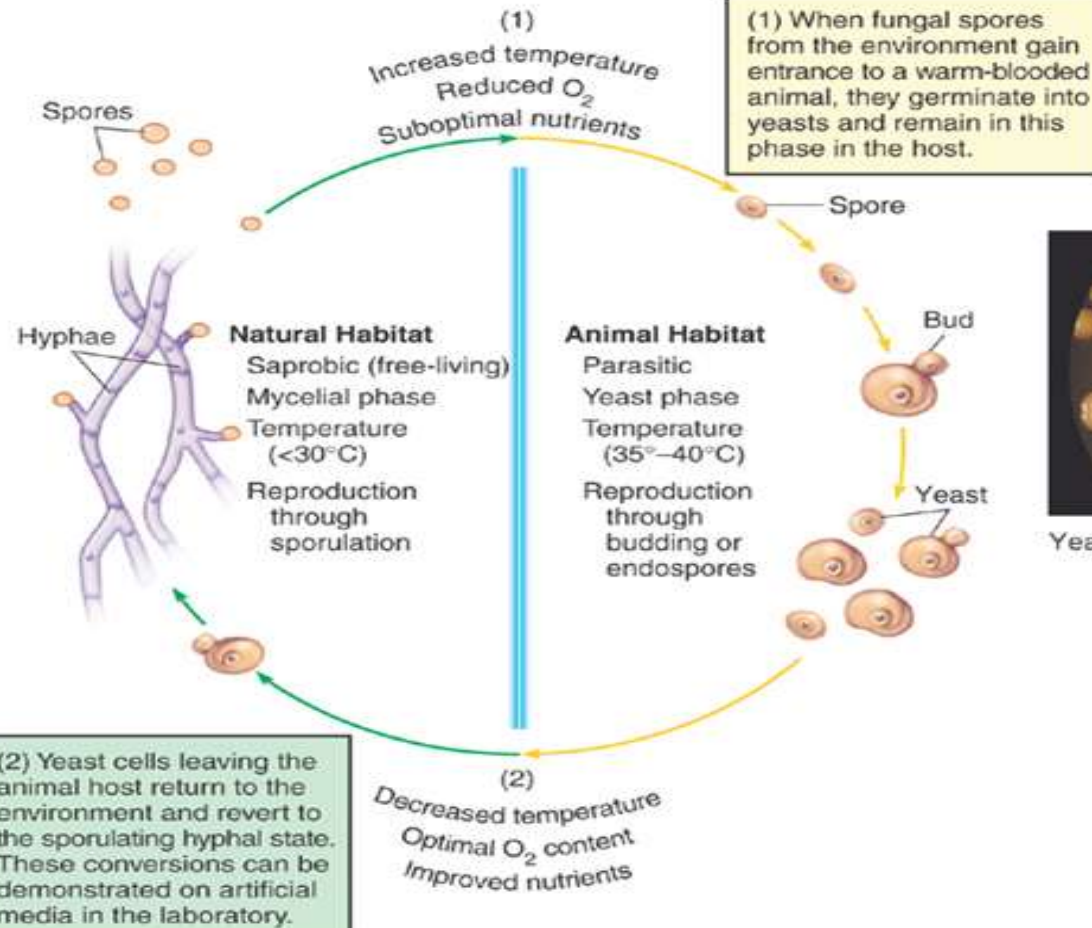
**Hyphael phase
(Saprophytic)**



**Yeast phase
(Parasitic)**

THERMAL DIMORPHISM

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Fungi reproductive classification

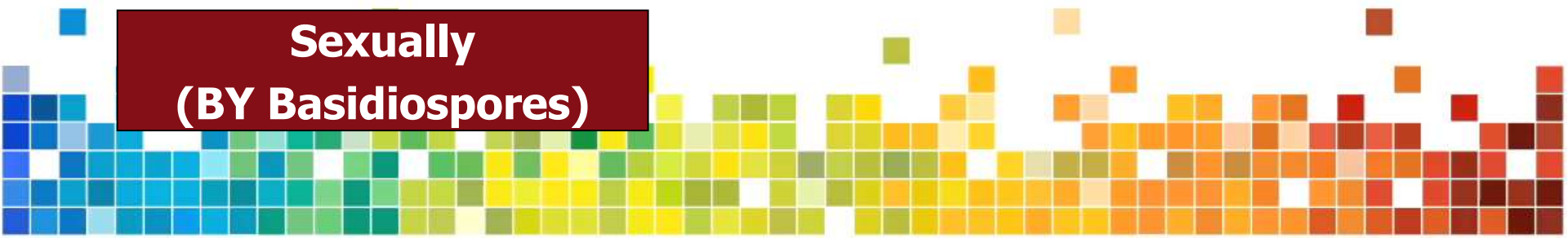
**Sexually
(rare)**

**Sexually
(BY Zygospores)**

**Sexually
(BY Ascospores)**

**Sexually
(BY Basidiospores)**

**Asexually
(mostly)**



ASEXUAL REPRODUCTION (ANAMORPH)

Asexual spores are:

Conidia

Blasto...

Phialo..

Chlamydo..

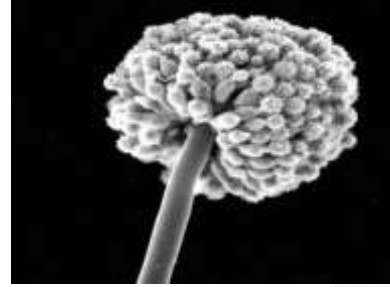
Arthro...

***Sporangio
spores***

BLASTO



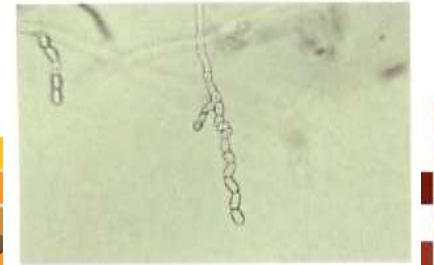
PHIALO



CHLAMYDO



ARTHRO



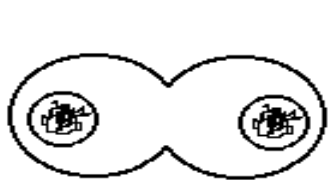
**Asexual
Conidia**

BLASTOCONIDIA:

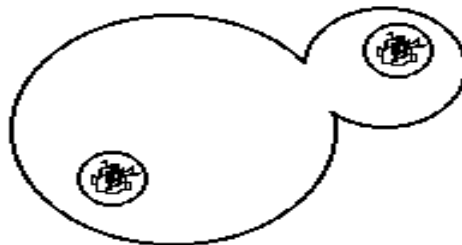
Asexual reproduction by budding as in yeasts

- Offspring grows out of parent
- Fast, somewhat simple
- Same DNA

Replicating Yeasts: Fission vs. Budding



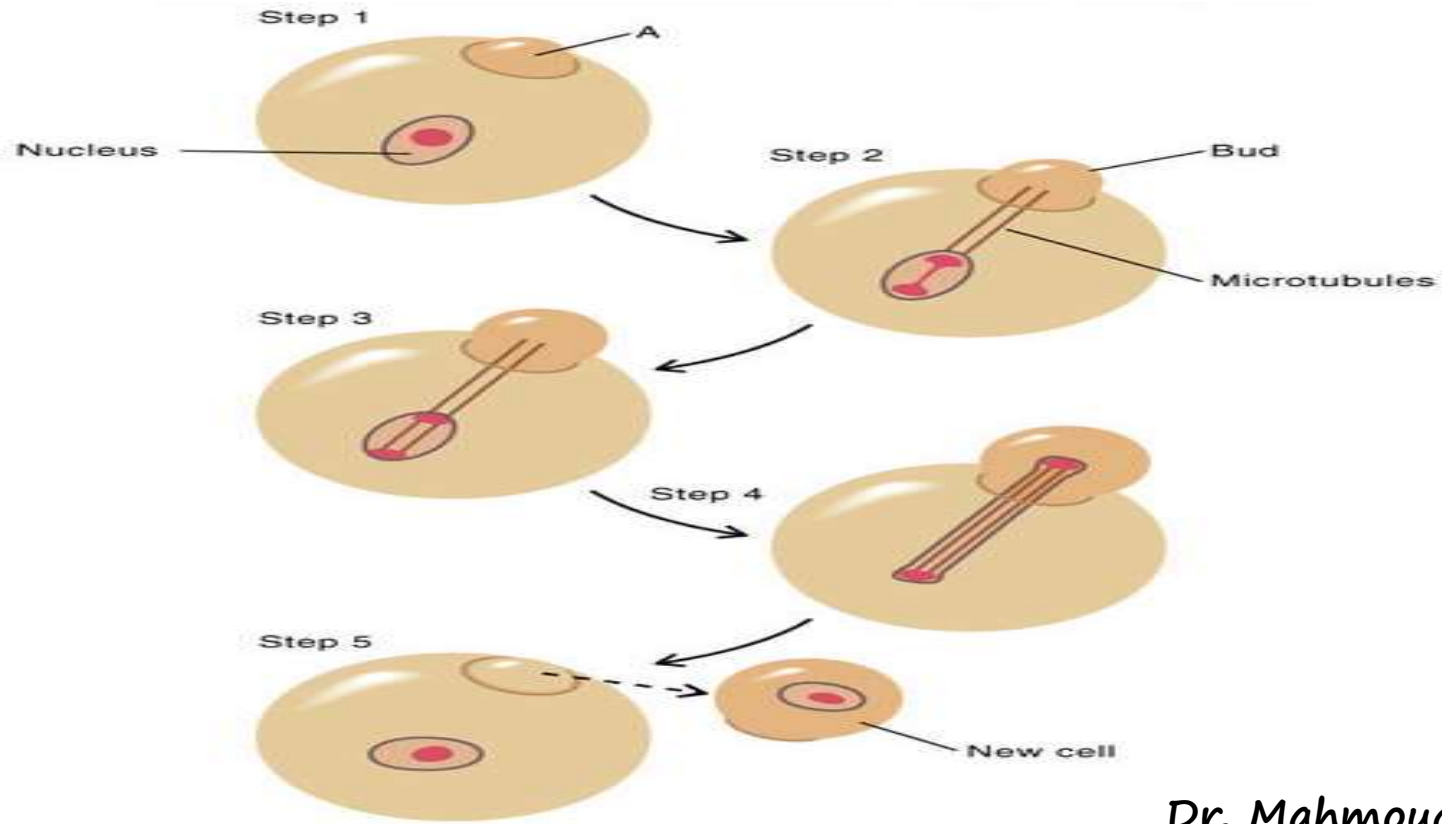
yeasts undergoing fission
Schizosaccharomyces spp.



budding yeasts
Saccharomyces spp.



BLASTOCONJUGIA:



BLASTOSPORE (BUDDING)

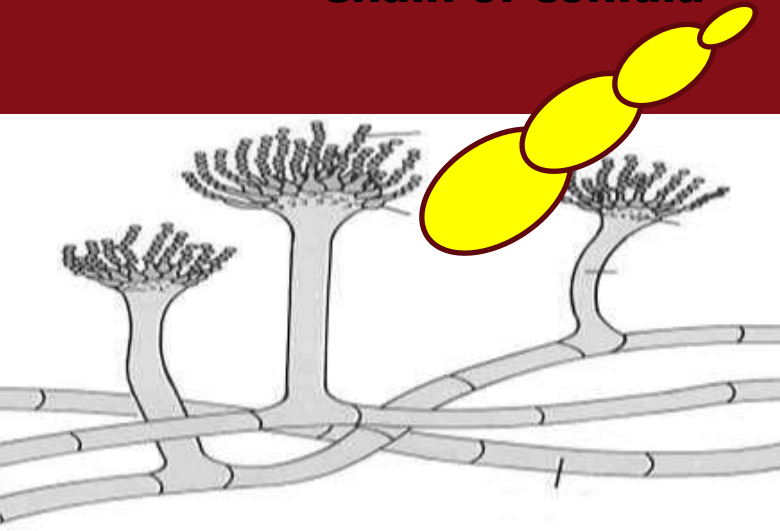


**Asexual
Conidia**

PHIALOCONIDIA:

By formation of flask shaped extension
(phialids) as in *Aspergillus*, *Penicillium*

Chain of conidia



PHIALOSPORE

**Asexual
Conidia**



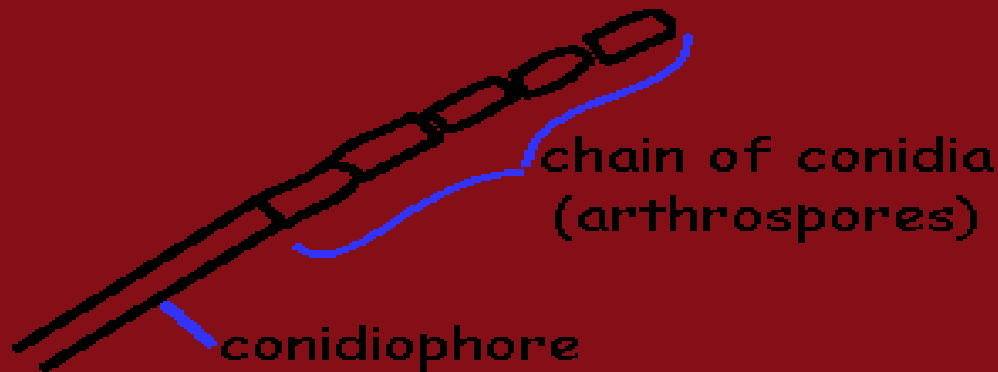
CHLAMYDOCONIDIA:

By formation of hyphal cell with thick wall which may terminal, lateral as *Candida albicans*



ARTHRODOCONIDIA:

By formation of fragmentation of septated hypha into the individual cell as *Geotrichum candidum*



ARTHROSPORE



**Asexual
Conidia**

SPORANGIOSPORES:

may be delimited within a sac-like structure, a sporangium (plural: sporangia), in which case they are called sporangiospores, borne on a sporangiophore only

In aseptated fungi

(Mucor)



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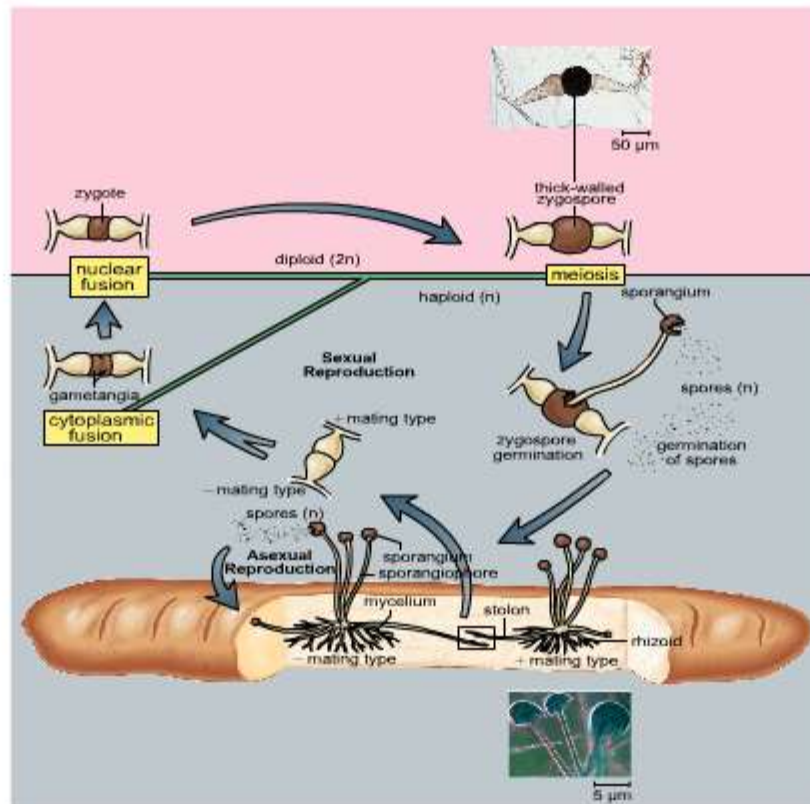


Figure 31.03
Black bread mold, *Rhizopus stolonifer*.



Fungi reproductive classification

**Sexually
(rare)**

**Sexually
(BY Zygosporoes)**

**Sexually
(BY Ascospores)**

**Sexually
(BY Basidiospores)**

**Asexually
(mostly)**

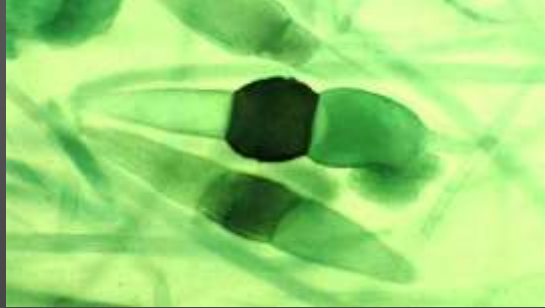


WE HAVE SPORES

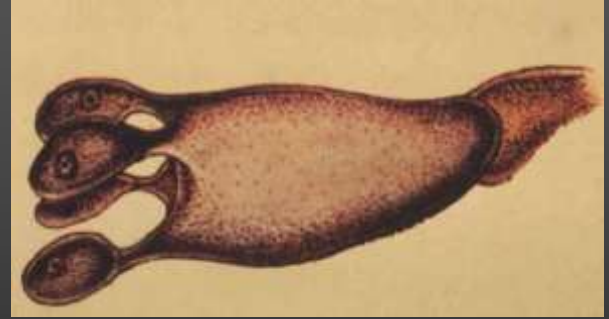
THREE TYPES OF SEXUAL



Ascospores



Zygospore



Basidiospores

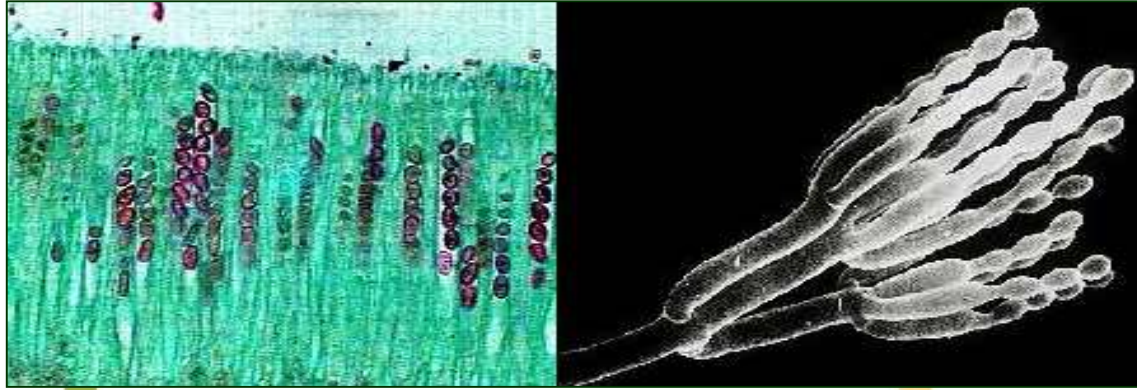
Sexual Reproduction (Teleomorph)

■ Sexual reproduction involves the union of two haploid mating type (plus) "+" and (minus) "-".

■ Hyphae of opposite mating types meet and fuse, bringing "+" and "-" nuclei together in one diploid cell.

Ascospores

- **Sexual spores** borne internally in a sac **called ascus**
- **Asexual spores** are borne externally as **conidia**



This phylum includes cup fungi, morels and most of the yeasts. Most crop plant pathogens belong in this phylum. When an asexual state is formed by these fungi they are usually externally borne spores called conidia.

Fungi Kingdom

Phylum Ascomycota

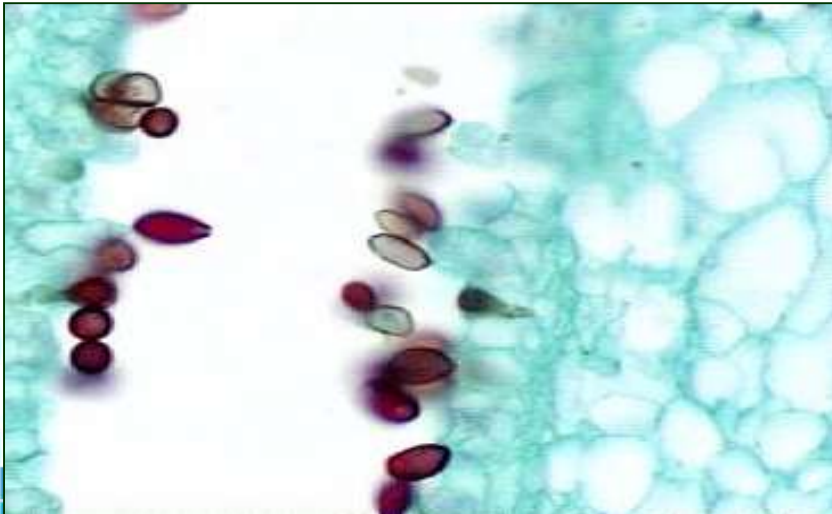
Phylum Basidiomycota

Phylum Zygomycota



Basidiospores

- Sexual spores borne externally on a club-shaped Structure called basidium
- Usually no asexual spores



This phylum includes familiar mushrooms, puffballs, and shelf fungi, along with the less familiar rusts and smuts. The basidia usually line up next to one another and form a hymenium.

Basidiospores: produced on basidium (mushrooms)

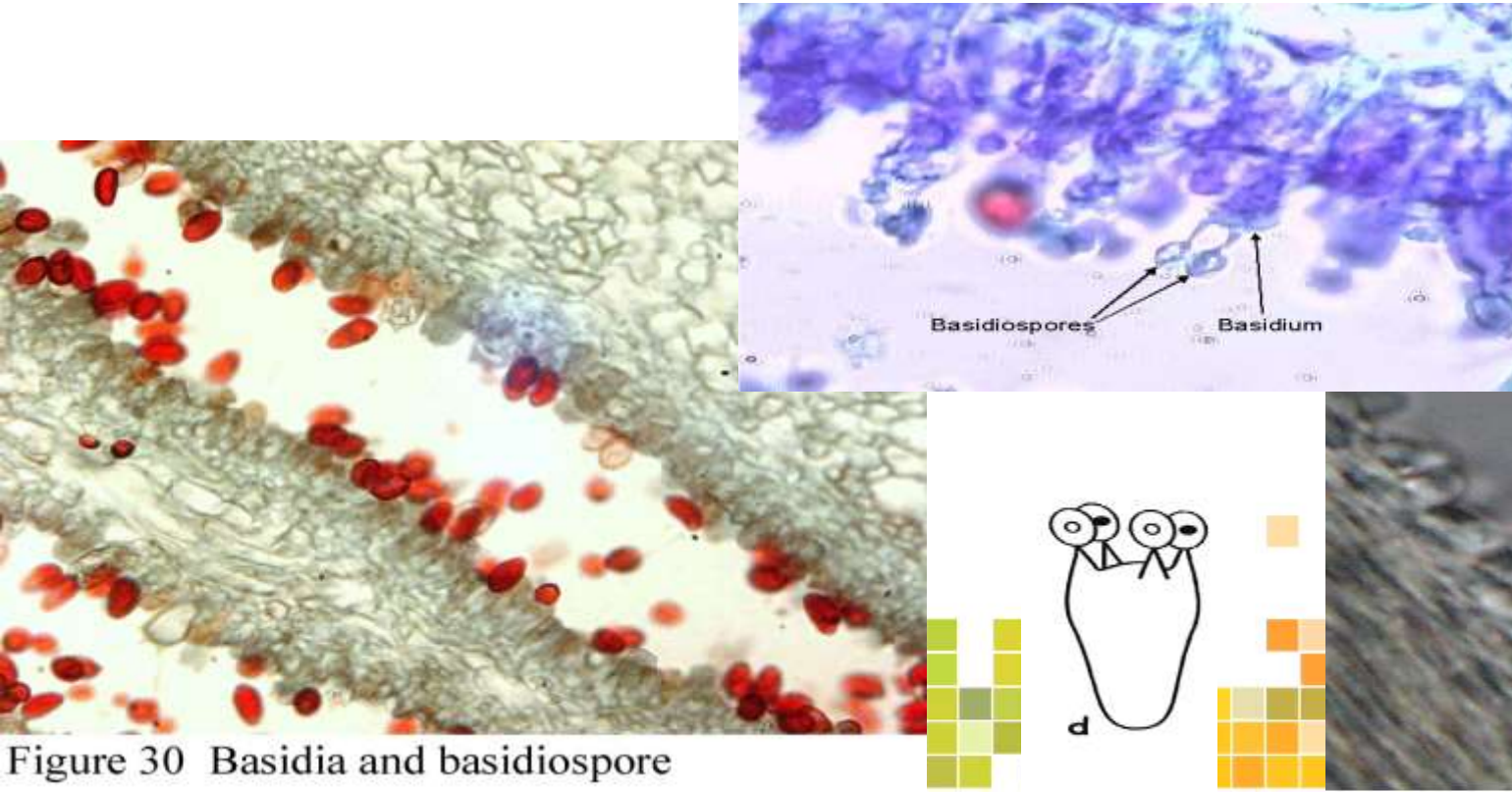
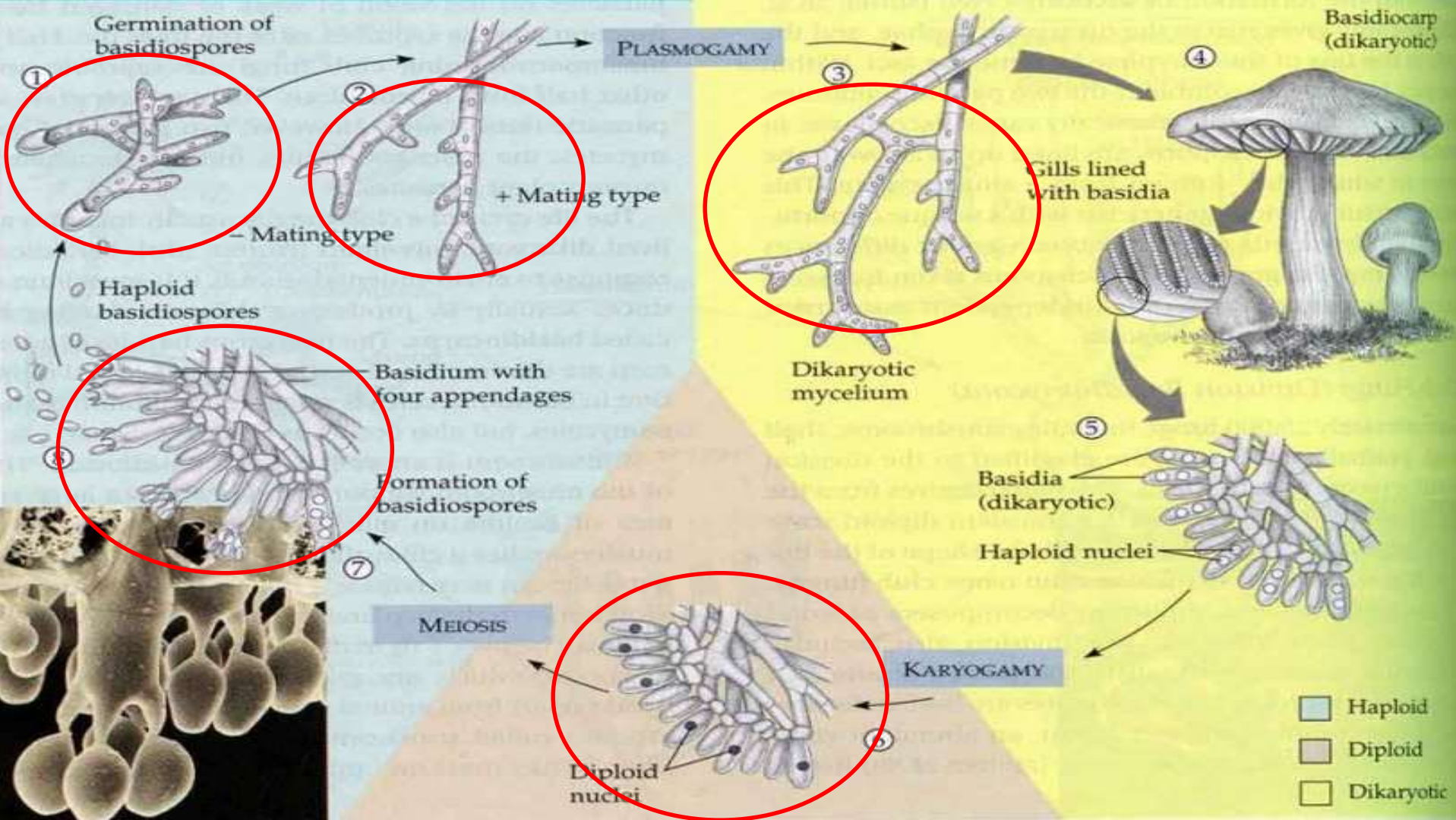


Figure 30 Basidia and basidiospore



Fungi Kingdom

Phylum Ascomycota

Phylum Basidiomycota

Phylum Zygomycota



Fungi Kingdom

Phylum Ascomycota

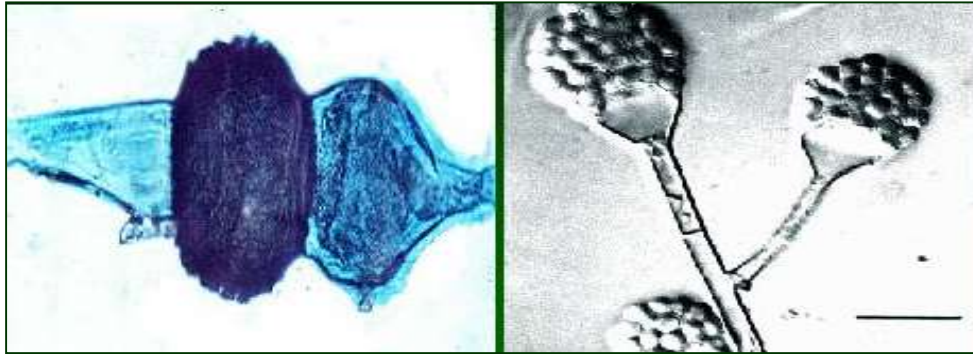
Phylum Basidiomycota

Phylum Zygomycota



Zygospores

- Sexual spores are thick walled resting spores called zygospores
- Asexual spores are borne internally in a sporangium



These are commonly called the bread molds. Most are saprophytic, but there are many that can act as plant and human pathogens.

Fungi Kingdom

Phylum Ascomycota

Phylum Basidiomycota

Phylum Zygomycota



Growth of Fungi

I) Growth Requirements:

Fungi need for their growth:

- A source of Carbon (*eg. CHO*)
- A source of nitrogen (*eg. Peptone*)
- Inorganic compounds (*eg. Ammonium nitrate*)
- Inorganic Nutrients (*eg. K, Ph, Mn*)
- Water (*absolute requirement for fungi*)

Growth of Fungi

II) Temperature

III) pH

IV) O₂ Requirement

V) Light

Fungal Metabolites (Products)

- 1) Mycotoxins**
- 2) Phytotoxins**
- 3) Antibiotics**
- 4) Pigments**
- 5) Enzymes**
- 6) Plant growth factors**



Thank You

A vibrant, high-contrast image of a waterfall cascading over mossy rocks in a dense, green forest. Four white doves are depicted in flight, one in each corner of the frame, symbolizing peace. The text "Thank You" is prominently displayed in the center in a large, yellow, italicized serif font with a white outline.

Thank You

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